

CLINICAL VIGNETTE

Sartorial Splendor, or a Potentially Career-Ending Injury?

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A 35-year-old woman presented for a sports medicine consultation with persistent right groin, hip, and thigh pain. The patient was an elite middle-distance runner and had begun experiencing pain in the right groin and hip approximately 7 months prior to presentation. The symptoms developed after a race, and the patient noted that she had markedly accelerated her training volume and intensity in the weeks leading up to that race. She was concerned by the pain so she took time off and engaged in non-impact cross training, and her symptoms eventually abated.

However, several months later, she resumed high volume, high intensity running and again developed pain in the right groin and hip after another race. The pain was worst at the right groin, with a secondary area of pain noted laterally at the right hip. In addition, she noted pain that seemed to stretch from the right hip anteriorly to the right distal thigh, near the medial aspect of the knee. Her pain worsened with running and other weight bearing, as well as with repeated hip flexion and attempted hip flexion with hip/leg adduction, as in crossing her right leg over her left knee. After consulting with her coach and reviewing her symptoms and anatomic pattern of pain, they felt rather certain she was suffering from an injury to her sartorius muscle.

Despite rest and stretching, the pain persisted, prompting the patient to consider her injury was more serious than a sartorius strain, so she sought evaluation from her primary care physician. X-rays of the pelvis and right hip were read as unremarkable. Due to the patient's ongoing symptoms, an MRI was performed, which was interpreted as consistent with a femoral neck stress reaction. The patient was placed on strict rest at first, with gradual resolution of her pain. She subsequently began swimming, using a pull buoy (a buoyancy device held between the legs to keep the lower body afloat and allow the legs to rest while the swimmer strokes with the arms). Eventually, she was able to walk pain-free but still had not been able to resume running at the time she presented for sports medicine consult, approximately 8 weeks after her MRI.

During the history, the patient reported a left pelvic stress fracture 3 years previously. She had regular menses and no history of eating disordered behavior, rheumatologic diathesis, malignancy, or metabolic bone disease. Review of her most recent (outside) labs from 1 year ago were notable only for a slightly low Vitamin D level. She had never had a DEXA scan. She had no history of systemic corticosteroid or anabolic steroid use. She had an IUD in place and was not taking any bisphosphonate or other medications or supplements on a regular basis.

Her physical exam was notable for a BMI of 19. She had excellent overall musculature and no deformity, edema, or tenderness was present about the hips or thighs. She did have decreased core stability and right hip flexor weakness on manual muscle testing. No pain was elicited with hip range of motion testing, nor were any clicks or clunks appreciated. Her hamstrings were quite tight bilaterally. Gait was painless, with grossly unremarkable biomechanics, but single leg hopping on the right was slightly painful.

Her pelvis and right hip x-rays were confirmed to be within normal limits, with no sign of fracture, stress reaction, arthritis, or other structural pathology.

Right hip MRI was notable for a Grade III stress reaction with severe bone marrow edema on T2 and T1 weighted images but no discrete fracture line involving the medial/inferior aspect of the femoral neck, a compression type injury. A trace hip joint effusion and incidental non-displaced tear of the superior labrum, felt to be asymptomatic were also noted.

The patient was advised to proceed with repeat MRI as she opted to avoid repeat x-rays due to concerns over additional radiation exposure to assess healing of the injury and was advised that she could continue her pain-free, pool based cross training. A DEXA scan and repeat labs were ordered including re-check of her Vitamin D level, calcium, phosphorus, BUN/Cr, TSH, and PTH. The plan is to monitor her closely and gradually advance her through a pain-free cross-training regimen, with sequential introduction of pool running, exercise biking, and elliptical machine, along with a physical therapy program to address her core muscle weakness and lower extremity soft tissue imbalances. When her injury has healed, she will then gradually proceed through a walk/jog program and then gradually build up her mileage, with eventual re-introduction of speedwork.

Femoral neck stress fractures are fairly uncommon injuries, accounting for approximately 3%-5% of all sports related stress fractures.^{1,2} They are significantly more common in women than in men and are found most often in distance runners and military recruits.^{1,2} Overtraining is thought to be a primary cause of these injuries, and they may also be associated with the female athlete triad, osteopenia /osteoporosis, eating disordered behavior, and oligo-/amenorrhea. They typically present with the gradual onset and progressive worsening of pain deep in the groin, which gets worse with running, jumping, and weight

bearing in general. It is very important to note that the pain may refer or radiate to the buttock, hip, or thigh. Because of these pain patterns, these injuries are often initially misdiagnosed as a groin strain, thigh strain, or even hip bursitis. In this patient's case, she and her coach thought that the sartorius muscle had been strained due to the pain radiating down from the hip to the medial aspect of the thigh near the knee and the associated pain she had with flexing and adducting her hip and leg. This motion, often used over the centuries by tailors when sewing clothes, gave rise to the name sartorius (meaning tailor in Latin) for the long, thin muscle (in fact, the longest muscle in the body) running from the anterior superior iliac spine to the pes anserine insertion at the medial aspect of the proximal tibia,³ that helps to accomplish this motion.

If an athlete continues loading the injured extremity continuing to run, they risk developing a completed stress fracture, which may then displace. Displacement is more likely with tension sided fractures involving the superior/lateral aspect of the femoral neck than with compression sided fractures (as seen in our patient), due to the force of gravity and anatomical geometry that favor distraction of the fracture ends. Completed stress fracture, especially with displacement, can be devastating, as it greatly increases the risk of developing avascular necrosis.⁴ This can result in the patient requiring hip arthroplasty, ending the career of a runner or other high impact athlete.

When a femoral neck stress fracture is suspected, the patient should be made non-weight bearing immediately, to decrease the risk of progression and/or displacement. Plain x-rays are often negative in the first 6-8 weeks after the injury occurs, so MRI is often necessary as a follow up exam. If a displaced fracture is seen, the patient should be placed on bed rest and urgent orthopedic surgical consult should be obtained for internal fixation.⁵ Many advise a trial of conservative care for a lower grade stress reaction, especially on the compression side, whereas tension sided injuries, even without displacement, often require surgical fixation.

With a non-displaced, compression side stress injury as in our patient, a gradual return to activity through a cross training program, with close monitoring, and physical therapy to address underlying biomechanical and soft tissue imbalances, is usually recommended. A recent study⁶ showed that return to running is dependent on the severity of the MRI stress injury grade, with mild (Grade 1) injuries requiring 7.4 weeks on average and 17.5 weeks being needed on average for Grade 4 injuries. Addressing training errors, nutritional status, and assessing for underlying eating disordered behavior are important considerations. If no clear risk factor is identified, evaluating for metabolic bone disease, rheumatologic diathesis, or neoplasm may be required.

In summary, a high index of suspicion is required to diagnose these potentially devastating injuries before fracture completion, displacement, or avascular necrosis can develop. If there is any question about the status of the injury at the time of the

initial exam, the patient should be made non-weight bearing and urgent imaging and sports medicine/orthopedic consult should be obtained.

REFERENCES

1. **Hulkko A, Orava S.** Stress fractures in athletes. *Int J Sports Med.* 1987 Jun;8(3):221-6. doi: 10.1055/s-2008-1025659. PMID: 3623785.
2. **McInnis KC, Ramey LN.** High-Risk Stress Fractures: Diagnosis and Management. *PM R.* 2016 Mar;8(3 Suppl):S113-24. doi: 10.1016/j.pmrj.2015.09.019. PMID: 26972260.
3. **Walters BB, Varacallo M.** Anatomy, Bony Pelvis and Lower Limb, Thigh Sartorius Muscle. 2021 Aug 17. In: *StatPearls [Internet].* Treasure Island (FL): StatPearls Publishing; 2022 Jan-. PMID: 30422484.
4. **Biz C, Berizzi A, Crimi A, Marcato C, Trovarelli G, Ruggieri P.** Management and treatment of femoral neck stress fractures in recreational runners: a report of four cases and review of the literature. *Acta Biomed.* 2017 Oct 18;88(4S):96-106. doi: 10.23750/abm.v88i4-S.6800. PMID: 29083360; PMCID: PMC6357658.
5. **Zhang BF, Wang PF, Huang H, Cong YX, Wang H, Zhuang Y.** Interventions for treating displaced intracapsular femoral neck fractures in the elderly: a Bayesian network meta-analysis of randomized controlled trials. *Sci Rep.* 2017 Oct 12;7(1):13103. doi: 10.1038/s41598-017-13377-1. PMID: 29026135; PMCID: PMC5638843.
6. **Ramey LN, McInnis KC, Palmer WE.** Femoral Neck Stress Fracture: Can MRI Grade Help Predict Return-to-Running Time? *Am J Sports Med.* 2016 Aug;44(8):2122-9. doi: 10.1177/0363546516648319. Epub 2016 Jun 3. PMID: 27261475.